Knowledge management: The key to delivering superior healthcare solutions


DOI: 10.4018/978-1-60566-701-0.ch011

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Chapter 11
Knowledge Management: The Key to Delivering Superior Healthcare Solutions

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ABSTRACT
The proliferation of ICT (information communication technologies) throughout the business environment has lead to exponentially increasing amounts of data and information generation. Although these technologies were implemented to enhance and facilitate superior decision making, the result is information chaos and information overload; the productivity paradox (O’Brien, 2005; Laudon & Laudon, 2004; Jessup & Valacich, 2005; Haag et al. 2004). Knowledge management (KM) is a modern management technique designed to make sense of this information chaos by applying strategies, structures and techniques to apparently unrelated and seemingly irrelevant data elements and information in order to extract germane knowledge to aid superior decision making. Critical to knowledge management is the application of ICT. However it is the configuration of these technologies that is important to support the techniques of knowledge management. This chapter discusses how the process oriented knowledge generation framework of Boyd and the use of sophisticated ICT can enable the design of a networkcentric healthcare perspective that enables effective and efficient healthcare operations.

INTRODUCTION
Healthcare is an information rich, knowledge intensive environment. In order to treat and diagnose even a simple condition a physician must combine many varied data elements and information. Such multispectral data must be carefully integrated and synthesized to allow medically appropriate management of the disease. Given the need to combine data and information into a coherent whole and then disseminate these findings to decision makers in a timely fashion, the benefits of ICT to support decision making of the physician and other actors throughout the healthcare system are clear (Wickramasinghe et al., 2006). In fact, we see the proliferation of many technologies such as
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HER (health electronic records), PACS (picture archive computerized systems) systems, CDSS (clinical decision support systems) etc. However and paradoxically, the more investment in ICT by healthcare the more global healthcare appears to be hampered by information chaos which in turn leads to inferior decision making, ineffective and inefficient operations, exponentially increasing costs and even loss of life (Wickramasinghe et al, 2005; 2006). The reason for this lies in the essentially platform centric application of ICT to date within healthcare, which at the micro level do indeed bring some benefits but at the macro level only add to the problem by creating islands of automation and information silos that hinder rather than enable and facilitate the smooth and seamless flow of relevant information to any decision maker when and where such information is required.

To remedy this problem and maximize the potential afforded by ICT and consequently alleviate the current problems faced by healthcare, the adoption of a networkcentric approach to healthcare operations would appear to be prudent. Such a networkcentric approach is grounded in a process oriented view of knowledge generation and the pioneering work of Boyd (von Lubitz & Wickramasinghe, 2006ab; von Lubitz & Wickramasinghe; 2005; Boyd, 1987).

BACKGROUND: KNOWLEDGE CREATION

The processes of creating and capturing knowledge, irrespective of the specific philosophical orientation (i.e. Lockean/Leibnitzian versus Hegelian/Kantian), has been approached from two major perspectives: namely a people-oriented perspective and a technology-oriented perspective.

The People-Oriented Perspective

This section briefly describes three well known people-oriented knowledge creation frameworks: namely, Nonaka’s Knowledge Spiral, Spender’s and Blackler’s respective frameworks. According to Nonaka (Nonaka, 1994; Nonaka & Nishiguichi; 2001): (1) Tacit to tacit knowledge transformation usually occurs through apprenticeship type relations where the teacher or master passes on the skill to the apprentice. (2) Explicit to explicit knowledge transformation usually occurs via formal learning of facts. (3) Tacit to explicit knowledge transformation usually occurs when there is an articulation of nuances; for example, as in healthcare if a renowned surgeon is questioned as to why he does a particular procedure in a certain manner, by his articulation of the steps the tacit knowledge becomes explicit and (4) Explicit to tacit knowledge transformation usually occurs as new explicit knowledge is internalized it can then be used to broaden, reframe and extend one’s tacit knowledge. These transformations are often referred to as the modes of socialization, combination, externalization and internalization respectively (ibid).

Spender draws a distinction between individual knowledge and social knowledge (yet another duality), each of which he claims can be implicit or explicit (Newell et al., 2002). From this framework we can see that Spender’s definition of implicit knowledge corresponds to Nonaka’s tacit knowledge. However, unlike Spender, Nonaka doesn’t differentiate between individual and social dimensions of knowledge; rather he merely focuses on the nature and types of the knowledge itself. In contrast, Blackler (ibid) views knowledge creation from an organizational perspective, noting that knowledge can exist as encoded, embedded, embodied, encultured and/or enbrained. In addition, Blackler emphasized that for different organizational types, different types of knowledge predominate, and highlights the connection between knowledge and orga-
nizational processes (ibid). Blackler’s types of knowledge can be thought of in terms of spanning a continuum of tacit (implicit) through to explicit with embrained being predominantly tacit (implicit) and encoded being predominantly explicit while embedded, embodied and encultured types of knowledge exhibit varying degrees of a tacit (implicit) /explicit combination.

In trying to integrate these various perspectives (Figure 1), what we see is that Spender’s and Blackler’s perspectives complement Nonaka’s conceptualization of knowledge creation and more importantly do not contradict his thesis of the knowledge spiral wherein the extant knowledge base is continually being expanded to a new knowledge base, be it tacit /explicit (in Nonaka’s terminology), implicit /explicit (in Spender’s terminology), or embrained /encultured /embodied /embedded /encoded (in Blackler’s terminology). What is important to underscore here is that these three frameworks take a primarily people-oriented perspective of knowledge creation. In particular, Nonaka’s framework, the most general of the three frameworks, describes knowledge creation in terms of knowledge transformations as discussed above that are all initiated by human cognitive activities. Needless to say that both Spender and Blackler’s respective frameworks also view knowledge creation through a primarily people oriented perspective. Typically, Hegelian and Kantian inquiring systems would incorporate knowledge creation that is consistent with people-oriented perspectives (Malhotra; 1997).

The Technology-Oriented Perspective

In contrast to the above primarily people-oriented perspectives pertaining to knowledge creation, knowledge discovery in databases (KDD) (and more specifically data mining), approaches knowledge creation from a primarily technology-oriented perspective. In particular, the KDD process focuses on how data is transformed into knowledge by identifying valid, novel, potentially useful, and ultimately understandable patterns in

Figure 1. The people perspective of knowledge generation
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data (Fayyad et al., 1996). KDD is primarily used on data sets for creating knowledge through model building, or by finding patterns and relationships in data. How to manage such newly discovered knowledge and other organizational knowledge is at the core of knowledge management.

Figure 2 summarizes the key steps within the KDD process; while it is beyond the scope of this chapter to describe in detail all the steps which constitute the KDD process, an important duality to highlight here is that between exploratory and predictive data mining. Typically, Lockean and Leibnizian inquiring systems would subscribe to a technology-oriented perspective for knowledge creation (Malhotra; 1997).

The Process-Oriented Perspective

Within knowledge management then, the two predominant approaches to knowledge creation as discussed above are the people centric and the technology centric perspectives (Wickramasinghe, 2006; von Lubitz & Wickramasinghe; 2006c). Essential to the perspective of knowledge creation is that knowledge is created by people and that new knowledge or the increasing of the extant knowledge base occurs as a result of human cognitive activities and the effecting of specific knowledge transformations [ibid, Figure 1]. In contrast, a technology driven perspective to knowledge creation is centred around the computerized technique of data mining and the many mathematical and statistical methods available to transform data into information and then meaningful knowledge [Figure 2] (Fayyad et al., 1996; von Lubitz & Wickramasinghe; 2006c; Adriaans and Zantinge, 1996; Cabena et al., 1998; Bendoly, 2003).

A process centric approach to knowledge creation not only combines the essentials of both the people centric and technology centric perspectives but also emphasises the dynamic and on going nature of the process of knowledge creation itself and supports simultaneously the Lockean/Leibnizian and Hegelian/Kantian systems of inquiry. Process centred knowledge generation is grounded in the pioneering work of Boyd and his OODA Loop, a conceptual framework that maps out the critical process required to support rapid decision making and extraction of critical, germane knowledge (Boyd, 1987; von Lubitz & Wickramasinghe; 2006c). The Loop is based on a cycle of four interrelated stages essential to support critical analysis and rapid decision making that revolve in both time and space: Observation followed by Orientation, then by Decision, and finally Action (OODA). At the Observation and Orientation stages, implicit and explicit inputs are gathered or extracted from the environment

Figure 2. The technical perspective of knowledge generation
(Observation) and converted into coherent information (Orientation).

The latter determines the sequential Determination (knowledge generation) and Action (practical implementation of knowledge) steps [ibid, Figure 3]. The outcome of the Action stage then affects, in turn, the character of the starting point (Observation) of the next revolution in the forward progression of the rolling loop.

Given that healthcare is such a knowledge rich environment that requires rapid decision making to take place that has far reaching consequences, a process-centred approach to knowledge generation is most relevant and forms the conceptual framework for network-centric healthcare operations.

**NETWORK-CENTRIC HEALTHCARE OPERATIONS**

Healthcare, like all activities conducted in complex operational space, both affects and requires the functioning of three distinct entities, i.e. people process and technology. To capture this dynamic triad that continually impacts all healthcare operations, the doctrine of healthcare network-centric operations is built around three entities that form mutually interconnected and functionally related domains. Specifically these domains include (von Lubitz & Wickramasinghe, 2006a,b, 2005):

1) a physical domain that:
   a. represents the current state of healthcare reality;
   b. encompasses the structure of the entire environment healthcare operations intend to influence directly or indirectly, e.g., elimination of disease, fiscal operations, political environment, patient and personnel education, etc.;
   c. has data within it that are the easiest to collect and analyze, especially that they relate to the present rather than future state;
   d. is also the territory where all physical assets (platforms) such as hospitals, clinics, administrative entities, data

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**Figure 3. The Process Perspective of Knowledge Generation**
management facilities, and all other physical subcomponents (including people) reside.

2) an information domain that:
   a. contains all elements required for generation, storage, manipulation, dissemination/sharing of information, and its transformation and dissemination/sharing as knowledge in all its forms;
   b. within the information domain, all aspects of command and control are communicated and all sensory inputs gathered;
   c. while the information existing within this domain may or may not adequately represent the current state of reality, all our knowledge about that state emerges, nonetheless, from and through the interaction with the information domain;
   d. all communications about the state of healthcare take place through interactions within this domain;
   e. the information domain is particularly sensitive and must be protected against intrusions that may affect the quality of information contained within domain.

3) A cognitive domain that:
   a. constitutes all human factors that affect operations;
   b. is within the cognitive domain that deep situational awareness is created, judgments made, and decisions and their alternatives are formulated;
   c. also contains elements of social attributes (e.g., behaviours, peer interactions, etc.) that further affect and complicate interaction with and among other actors within the operational sphere.

In essence, these domains cumulatively serve to capture and then process all data and information from the environment and given the dynamic nature of the environment new information and data must always be uploaded. Thus, the process is continuous in time and space captured by the ‘rolling nature’ of Boyd’s OODA Loop (i.e. is grounded in the process oriented perspective of knowledge generation).

ICT USE IN HEALTHCARE NETWORK-CENTRIC OPERATIONS

The critical technologies for supporting healthcare network-centric operations are not new, rather they are reconfigurations of existing technologies including web and Internet technologies. The backbone of the network is provided by WHIG (world healthcare information grid) (von Lubitz & Wickramasinghe, 2006ab; von Lubitz & Wickramasinghe; 2005). WHIG consists of three distinct domains that are each made up of multiple grids all interconnecting to enable complete and seamless information and data exchange throughout the system. Figure 4 depicts the WHIG with its distinct yet interconnected domains each made up of interconnecting grids. The three essential elements of the grid architecture are the smart portal which provides the entry point to the network, the analytic node and the intelligent sensors [ibid]. Taken together these elements make up the knowledge enabling technologies to support and effect critical data, information and knowledge exchanges that in turn serve to ensure effective, efficient healthcare operations. In network-centric healthcare operations the entry point or smart portal must provide the decision maker with pertinent information and germane knowledge constructed through the synthesis and integration of a multiplicity of data points; i.e. support and enable OODA thinking. Unlike current web pages in general and especially current medical web-portals and on-line databases such as MedLine, that provide the decision maker with large amounts of information that he/she must then synthesise and determine relative and general relevance; i.e.
they are passive in nature, the smart portal enables the possibility to access the critical information required to formulate the Action (practical implementation) stage of Boyd’s Loop. In addition, the smart portal includes the ability to navigate well through the grid system; i.e. the smart portal must have a well structured grid map to identify what information is coming from where (or what information is being uploaded to where). In order to support the ability of the smart portal to bring all relevant information and knowledge located throughout the grid system to the decision maker there must be universal standards and protocols that ensure the free flowing and seamless transfer of information and data throughout WHIG; the ultimate in shared services. Finally, given the total access to WHIG provided by the smart portal to the decision maker it is vital that the highest level of security protocols are maintained at all times; thereby ensuring the integrity of WHIG. Figure 5 captures all these key elements of the smart portal.

The analytic nodes of the WHIG perform all the major intelligence and analysis functions and must incorporate the many tools and technologies of artificial intelligence and business analytics including OLAP (on-line analytic processing), genetic algorithms, neural networks and intelligent agents in order to continually assimilate and analyze critical data and information throughout the grid system and/or within a particular domain. The primary role of these analytic nodes is to enable the systematic and objective process of integrating and sorting information or support the Orientation stage of Boyd’s Loop. Although we discuss the functional elements of the analytic node separately, it is important to stress that the analytic node is in fact part of the smart portal. In fact, the presence of the analytic node is one of the primary reasons that the smart portal is indeed “smart” or active rather than its more passive distant cousin the integrated e-portal that dominates many intranet and extranet sites of e-businesses today. The final important technology element of WHIG is the intelligent sensor. These sensors are essentially expert systems or other intelligent detectors programmed to identify
changes to WHIG and data and/or information within a narrow and well defined spectrum, such as for example, an unusually high outbreak of anthrax in a localized geographic region, which would send a message of a possible bio-terrorism attack warning to the analytic node, or perhaps the possibility of spurious or corrupt data entering the WHIG system. The sensors are not necessarily part of the smart portal and can be located throughout WHIG independent of the analytic nodes and smart portals Figure 5 depicts the three essential technical components of WHIG.

In explanation of Figure 5, data, information, or queries from WHIG enter through the portal where they are subjected to security/standards/protocol screening then various intelligence techniques (e.g. data mining and business intelligence) are performed. The latter provides detailed sorting and redirection via intra and extra nets, and/or Internet/Web to other locations within the node, e.g., patient records, information storage sites, analysis and knowledge generating sites, etc. (unidirectional arrows.) All sites within the node are capable of multidirectional communication (not indicated for the sake of clarity). Their output are transmitted to the Knowledge Manipulation and Generation site which, in turn, generates final output stored within the node and also disseminated throughout the network (Out). If needed, the node can distribute additional WHIG-wide queries. Replies are collected, manipulated at the KM level, and incorporated into the final node output.

Although neither the portal nor individual functional aspects of the node need be collocated, their operations are conducted as a single, self-contained unit, i.e., none of the constituting elements can participate individually in the functions of another node. Self-containment of each node adds to its security and reduces the risk of inadvertent network-wide dissemination of integrity-compromising factors (e.g., viruses, spurious data, etc.).

**KNOWLEDGE DEVELOPMENT, SUPPORT AND DISSEMINATION**

Research by von Lubitz and Wickramasinghe (2006a,b) has pointed out that healthcare information quality depends inversely on its range,
i.e., the shorter the distance between the source and recipient, and the lesser degree of information content manipulation, the higher the quality. Similar observations have been made by other authors in the context of military activities whose complexity closely matches that of healthcare (Alberts et al., 2000). At the moment, and even more so in the future, the highest quality of healthcare information reposes within medical libraries associated with major medical centers around the globe. However, despite over a twenty year long history of IAIMS (Integrated Advanced Information Management System) initiative (Matheson, 1995) and increasing need for a drastic change of operational philosophy (Kronenfeld, 2005; Blansit and Connor; 1999), the majority of medical libraries continue to function as the repositories for print-based knowledge (or its electronically disseminated substitute) whose participation in healthcare operations is driven by customer demand (essentially passive) rather than operate as dynamic, knowledge developing and disseminating entities capable of actively shaping the healthcare world. As pointed out by several authors [37-39] (Blansit, 1999; du Val, 1967; Fuller et al., 1999) future medical libraries must “filter, focus, and interpret information” (Stead, 1998) and “distribution of information, not control, is key to establishing, and maintaining power” (Martin, 1997). In the context of network-centric healthcare operations the role of medical libraries transforms even further – the library becomes a node.

Presently, major strides are made toward practical incorporation of the IAIMS concept in reality (McGowan et al., 2004; Guard et al., 2004). However, global scale ‘network-centricity’ demands capabilities extending beyond “reliable, secure access to information that is filtered, organized, and highly relevant to specific tasks and needs…” (McGowan et al., 2004). In addition to these essential requirements, network-centric operations demand merging of multispectral information streams into coherent, operation-centered knowledge bases, development of real-time or near real-time operational space awareness, and predictive capabilities that are beyond the current scope of medical library operational profiles. Thus, contrary to the technologically advanced library of today, the library-node of tomorrow must adopt Boyd’s Loop principles of interaction with the environment as the principal philosophy of its interaction with the information world within which it functions (von Lubitz & Wickramasinghe, 2006a). Adaptation of such philosophy is also the critical step in transforming operational profile of the existing medical libraries from essentially passive repositories which, with varying degree of efficiency and reliability, transform the reposed information into coherent knowledge-base blocks, into active information seeking entities (nodes) that conduct their exploratory work not only within their pre-determined domain of healthcare, but also within all other domains whose content may be potentially relevant to healthcare itself. There is no doubt that the proposed change is fundamental. On the other hand, it is the change that moves the medical library beyond its current notion of the institutional “networked biomedical enterprise” [40] into a global-level knowledge development, -management and -dissemination center. Most significantly, aligning such centers within the WHIG structure will lead to a massive enhancement of their overall operational power which (von Lubitz & Wickramasinghe, 2006a), accordingly to Metcalf’s law, increases in proportion to the square of the nodes connected to the network.

**INFORMATION INTEGRITY**

Given the significance of WHIG to network-centric healthcare and the importance of high quality information to support the rapid decision making activities and the reduction of information asymmetry relative to the environment, it is essential that the information that flows through WHIG is reliable. One technique in order to ensure that the
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Information and/or knowledge accessed from the grid structure is indeed reliable, relevant and of a high quality if it meets key criteria of information integrity and quality aims. Such criteria include that all information accessed should display the attributes of accuracy, consistency, and reliability of content and processes as well as the dimensions of usefulness, completeness, manipulability and usability (Wickramasinghe & Fadlalla, 2004; Huang et al., 1999). Table 1 highlights these dimensions of information integrity:

Implicit in taking an Information Integrity perspective is the shift from viewing information as a byproduct to viewing it as an essential product (Wickramasinghe & Fadlalla, 2004). Such a perspective is paramount in a network-centric healthcare domain given its goal of the attainment of information superiority in order to enable the delivery of quality healthcare delivery in the healthcare space. The following four key principles should be adhered to at all times when information exchanges (either accessing or uploading of information to the grid) at the node take place; namely the information must 1) meet the consumers information needs, 2) be the product of a well defined information production process 3) be managed by taking a life-cycle approach and 4) be managed and continually assessed vis-à-vis the integrity of the processes and the resultant information (Cebrwoski & Garstka, 1998; Wickramasinghe & Fadlalla, 2004; Huang et al., 1999). This in turn requires that specific protocols must be enforced at the design stage of the node and that sensors within the WHIG can be used to detect information and data that is both spurious or failing to meet one or more of the

Table 1. Information Integrity (Wickramasinghe & Fadlalla, 2004; Huang et al., 1999)

<table>
<thead>
<tr>
<th>Component</th>
<th>Key dimensions</th>
</tr>
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<tbody>
<tr>
<td>Accuracy</td>
<td>Information must be correct:</td>
</tr>
<tr>
<td></td>
<td>• <strong>Information Content Accuracy</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Process Logic Correctness and Accuracy</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>System Accuracy to Specifications</strong></td>
</tr>
<tr>
<td>Reliability</td>
<td>Information must be from a sound source and verifiable:</td>
</tr>
<tr>
<td></td>
<td>• <strong>Information Currency</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Information Auditability</strong></td>
</tr>
<tr>
<td>Consistency</td>
<td>Information must not change unless the circumstances themselves change:</td>
</tr>
<tr>
<td></td>
<td>• <strong>Content Consistency</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Temporal/Spatial Consistency</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Relational Consistency</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Process/System Consistency</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Standardization</strong></td>
</tr>
<tr>
<td>Completeness</td>
<td>Information should contain all available data element:</td>
</tr>
<tr>
<td></td>
<td>• <strong>Collectively Exhaustive</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Minimal missing data points</strong></td>
</tr>
<tr>
<td>Usefulness</td>
<td>Information that is stored and accessed must be required for a specific tasks:</td>
</tr>
<tr>
<td></td>
<td>• <strong>Information Relevancy</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Germane knowledge</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Value Added Characteristic</strong></td>
</tr>
<tr>
<td>Usability</td>
<td>Information that is stored and accessed must be in a form that it can be applied to a given context easily:</td>
</tr>
<tr>
<td></td>
<td>• <strong>Information Simplicity</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Information Portability</strong></td>
</tr>
<tr>
<td>Manipulability</td>
<td>Information should be able to support understanding, decision making and analysis:</td>
</tr>
<tr>
<td></td>
<td>• <strong>Content Richness</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Contextual Coverage</strong></td>
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</tbody>
</table>
criteria for information integrity on an ongoing basis.

DISCUSSION AND CONCLUSION

At its most fundamental (and maybe also the most naïve) healthcare is about assuring and maintaining individual’s adequate level of health necessary to function as a fully capable member of the society. In reality, healthcare, particularly in its global context, became a business growing at an unprecedented rate, where global disparities in healthcare delivery become increasingly more apparent, where technology emphasizes them rather than assists in their obliteration, and where the current expenditure of trillions of dollars yearly appears to have no impact at all. Part of the problem rests with the fact that the majority (if not all) solutions to the healthcare crisis are, essentially, ‘platform-centric’, i.e. concentrate on the highly specific needs of a specialty (e.g., molecular biology), an organization (e.g., hospital) or a politically defined region (e.g., US or EU). Hence, most of the technology-based solutions, while highly functional and of unquestionable benefit to their users, fail to act as collaborative tools assisting in the unification rather than subdivision of effort. Highly useful information generated within individual systems is, for all practical purposes, lost since it is inaccessible to others either because of its incompatibility with different operational platforms or simply because others are not even aware of its existence! The latter issue becomes particularly significant when relevant information exists within healthcare-unrelated domains. Particularly apt and very recent example of such failure were the recovery efforts after the tsunami disaster of 2004, where the world dispatched badly needed medical supplies to the affected regions but failed to relate the transport to on site distribution. The supplies piled up at major airports while healthcare workers in the field were short of the most basic commodities.

The currently practiced approach to healthcare informatics supports reoccurrence of similar events: for all practical purposes healthcare informatics limits its sphere of activity only to subjects strictly related to medicine, its practice, and administration at the healthcare organization level. Yet, healthcare relates to a number of other elements of life – political structure of the region, its stability, its economy, even its weather. By taking a myopic platform centric perspective to healthcare delivery the current problems and challenges facing healthcare delivery should not be a surprise. These challenges include inability to transfer critical information seamlessly throughout the healthcare network, inability to have the best available information and knowledge to support decision making, escalating costs due to inherent inefficiencies, inferior treatment outcomes and even deaths. In today’s knowledge economy where ICT use is a necessity for conducting and enabling effective business operations and a global business perspective is essential it would appear that to enable and support superior healthcare operations a network-centric approach that is integrally connected to the process perspective of knowledge management and reliant on a complex technology grid (WHIG) may provide the key. What is certain is that without a radical redesign of current healthcare operations the healthcare industry will continue to be a laggard and healthcare delivery will always be suboptimal.

In closing, it is important to note that the proposed network centric approach to healthcare delivery also serves to underscore the inextricable connection and intertwining of e-health and e-government which to date has rarely been researched if at all. Moreover, for such a model to become adopted successfully it requires governments to develop polices and protocols which will in turn facilitate its usability. This will include at least four key areas that will have an important impact on the development of these necessary policies and protocols; namely, the following factors:
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1) IT education:
   ◦ A sophisticated, well educated population boosts competition and hastens innovation;
   ◦ One of the key factors to a country’s strength in an industry is strong customer support;
   ◦ The health consumer is the key driving force in pushing e-health initiatives;
   ◦ a more IT educated healthcare consumer would then provide stronger impetus for e-health adoption.

2) Morbidity:
   ◦ There is a direct relationship between health education and awareness and the overall health standing of a country;
   ◦ A more health conscious society, which tends to coincide with a society that has a lower morbidity rate, is more likely to embrace e-health initiatives;
   ◦ Higher morbidity rates tend to indicate the existence of more basic health needs and hence treatment is more urgent than the practice of preventative medicine and thus e-health could be considered an unrealistic luxury;
   ◦ Thus, the modifying impact of morbidity rate is to prioritize the level of spending on e-health versus other basic healthcare needs.

3) Cultural/social dimensions:
   ◦ Healthcare has been shaped by each nation’s own set of cultures, traditions, payment mechanisms and patient expectations;
   ◦ While the adoption of e-health, to a great extent, dilutes this cultural impact, social and cultural dimensions will still be a moderating influence on any countries e-health initiatives;
   ◦ Another aspect of the cultural/social dimension relates to the presentation language of the content of the e-health repositories;
   ◦ The entire world does not speak English so the e-health solutions have to be offered in many other languages;
   ◦ The e-health supporting content in web servers/sites must be offered in local languages, supported by pictures and universal icons;
   ◦ Therefore, for successful e-health initiatives it is important to consider cultural dimensions.

4) World economic standing:
   ◦ Economies of the future will be built around the Internet;
   ◦ All governments are very aware of the importance and critical role that the Internet will play on a country’s economy;
   ◦ This makes it critical that appropriate funding levels and budgetary allocations become a key component of governmental fiscal policies so that such initiatives will form the bridge between a traditional healthcare present and a promising e-health future.

Thus, the result of which would determine success of effective e-health implementations and consequently have the potential to enhance a country’s economy and future growth. Interestingly enough, however these areas also impact the development of many e-government initiatives. Therefore, while knowledge management driven ICT innovations for healthcare delivery hold the key to enabling the delivery of superior healthcare operations it must not be forgotten that such innovations will only be successful if the necessary policy and government infrastructure is in place to support the correct levels of competition and collaboration between and within the healthcare web of players.
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